

A nest containing four eggs was found on March 18th. They resemble brownish eggs of *Vanellus vulgaris*, but are less pyriform and much smaller. The deep brown patches are all more or less longitudinal.

Measurements: 41.1 by 28.5, 40 by 27.5, 40 by 27.5, and 40 by 28.5 mm.

108. *PLUVIANUS ÆGYPTIUS* (Linn.).

12 ♂, 13 ♂, 97 ♀, 98 ♀, 257 ♀, 338 ♀, 360 ♀.

These pretty birds were fairly well distributed along the river-banks in small flocks. Towards the end of March they were evidently just on the point of breeding and occurred in pairs; the ovaries of the females were very much enlarged, and we often observed them scratching holes in the sand and then covering them up, as though they were burying their eggs. This habit is well known to the natives, who also are acquainted with the eggs, which they describe as being green. Curiously enough, they call this bird "Asfur el timsah," that is, "Bird of the Crocodile"; so there may be something in Herodotus's story of the Trochilus after all!

EXPLANATION OF PLATE I.

Fig. 1. *Cisticola aridula*, p. 16.

2. Egg of *Passer rufidorsalis*, p. 9.

3, 4. Eggs of *Caprimulgus eximius*, p. 20.

II.—*Notes upon the Osteology of Aramus scolopaceus*. By FRANK E. BEDDARD, M.A., F.R.S., Prosector and Vice-Secretary of the Zoological Society of London.

OPINIONS as to the exact systematic position of this curious bird have differed and still differ greatly. A list of the varying views that have been held at one time or another as to the relationships of *Aramus* is to be found in Fürbringer's 'Untersuchungen'*. From this it will appear that the bulk of current opinion is in favour of keeping the bird in the place which is assigned to it in the last edition of the 'Vertebrate List,' where it is joined with the Cranes, Bustards, *Cariama*, *Rhinochetus*, *Psophia*, and *Eurypyga* to form Mr. Sclater's

* 'Untersuchungen zur Morphologie und Systematik der Vögel,' &c. (Amsterdam, 1888), p. 1207.

Order Alectorides, of which Order it is furthermore considered to represent a distinct family. Prof. Fürbringer himself, though he discusses the general characteristics of *Aramus* under the heading "Aramidæ," comes to the final conclusion that it is to be placed as a mere subfamily of the family Gruidæ, of which all the Old World genera—*Grus*, *Balearica*, &c.—should constitute a second subfamily, Gruinæ. Even with this reduction the importance attached to *Aramus* as a distinct type of bird appears to me to be due to a slight exaggeration of its peculiarities. A study of the osteology has convinced me that it does not help to explain the structure of the genus to regard it as extremely distinct from other Cranes, using this word to include the Gruidæ only. If *Aramus* is to be separated, and given family—or subfamily—rank, then it will be necessary to isolate at least *Balearica* in the same way, and possibly also *Tetrapteryx*. No advantage appears to be gained by the splitting up of so clearly definable a family as that of the Gruidæ, of which *Aramus* is an outlying member, and, even as such, not far removed from the remaining genera.

My conclusions, in fact, completely bear out the view of the late Mr. Seebohm*, who placed *Aramus* as a genus of the family Gruidæ in his suborder Grallæ. As to the particular position which the genus holds within the family, I shall have in the course of the following pages to point to a number of somewhat striking likenesses between it and the African genus *Balearica*, which in external appearance is as unlike *Aramus* as any other genus of the family, or indeed even more unlike. Without, however, insisting too strongly upon these points of resemblance as indicating a special affinity, I may remark that alliances between South-African and South-American animals have been shown to exist in a number of groups.

The anatomy of *Aramus* has been dealt with and described by a number of naturalists. The muscles and viscera, with some parts of the skeleton, have been described by the late Mr. Garrod †, who quotes earlier authorities in his memoir.

* 'Classification of Birds' (London, 1890), p. 39.

† "On the Anatomy of *Aramus scolopaceus*," P. Z. S. 1876, p. 275.

I have already referred to Prof. Fürbringer, in whose general work upon Birds are a number of osteological details. I have myself* subsequently referred to a few osteological facts in considering the affinities of *Psophia* to other Crane-like birds, and the genus is not passed over in the general works of Dr. Gadow† and myself‡. An account of the alimentary tract has been communicated by Dr. P. Chalmers Mitchell to the Linnean Society of London, and will probably be published before the present observations appear in print.

The skeleton, with which alone I am concerned in the present communication, has been described and figured to some extent by Eyton in the 'Osteologia Avium' ||, by Garrod in his memoir quoted below, and by Fürbringer and myself. While these authors have made known the general facts which bear upon the systematic position of the bird, a number of details have not been discussed, some of which have a bearing upon the relationship of *Aramus* to the Cranes.

§ SKULL.

I shall not give any elaborate description of the skull, which has been depicted from two points of view by Garrod, and also in the general figure of the entire skeleton by Eyton. In being schizognathous and schizorhinal, in having large free lacrymals not united to the prefrontal processes of the ethmoid, in having but slight furrows for the nasal glands, and, finally, in the possession of occipital foramina, the genus *Aramus* agrees with the Gruidæ alone among its possible allies; both the Rallidæ and the Limicolæ differ in one or more of the above-stated characters, which are only combined in the Gruidæ. It seems to be unnecessary to take any other group of birds into consideration. Besides these general points of resemblance to *Grus* and the Gruidæ in general, the skull of *Aramus* shows a few minutiae of

* "On the Structure of *Psophia*," &c., P. Z. S. 1890, p. 329.

† "Aves" in Bronn's 'Klassen und Ordnungen des Thierreichs.'

‡ 'The Structure and Classification of Birds' (London, 1898).

|| Plate xiv. K and pl. xxvii. fig. 2.

structure in which it differs from its allies. These features, on the whole, produce a further likeness between the skull of *Aramus* and that of the aberrant Crane *Balearica*. Thus the pterygoids, though expanded as in *Grus* at their articulation with the palatines in front, have no traces that I can discover of basipterygoid facets. In *Grus* these basipterygoid facets are not properly developed; but, as in many other birds which possess rudiments of them, they are represented by a small process of bone of irregular form, and are not expanded into an articular surface for the reception of the pterygoid bones. In this peculiarity of the skull the genus *Balearica* agrees with *Aramus*; while in neither are there traces of the basipterygoid facets. One would assume therefore that the two genera which have just been mentioned are so far more specialized than the more typical Cranes. The shape of the maxillo-palatine plates is not the same in *Aramus* and in *Grus*: in *Aramus* these plates are of the nature of swollen bullæ, and very thin-walled; in *Grus* each plate is a thin, shell-like, concave structure, the concavity being outwards; they are, moreover, much larger in *Grus* than in *Aramus*. It is perhaps important to note that *Balearica*, again, on the whole, agrees with *Aramus*.

The remaining feature of difference between *Aramus* and *Grus*, which is noticeable on the ventral aspect of the skull, concerns the palatines: in *Grus* the ridge upon the ventral surface of these bones is deep, and is continued quite to the end of them, to where they articulate behind with the pterygoids; in *Aramus* the ridge is, of course, present, but it stops considerably short of the pterygoid end of the palatines. In this feature it happens that *Aramus* does not approach *Balearica*. The last-mentioned genus has these bones formed as in *Grus*.

When the skull of *Aramus* is viewed laterally, the nostrils are seen to be not so clearly cut anteriorly as are those of *Grus*, which end in a definite rounded margin. In *Aramus* a kind of curtain of bone descends from above which overshadows and partly obliterates the anterior part of the orifice of the nostril, thus detracting from the definiteness of its

outline. On the same aspect of the skull the quadrates are completely visible, as is also the case with the quadrates of the Crane *Balearica*. In *Grus*, on the other hand, there is a slight projecting bar of bone belonging to the squamosal, which has grown over the articular end of the quadrate between its two heads; this to some extent conceals the actual articulation of the quadrate when the skull is placed in an accurately horizontal position and viewed from the side. The same small bar of bone, it is true, does exist in the case of the two genera *Aramus* and *Balearica*; but it is much smaller and is not effectual in concealing the quadrate articulation.

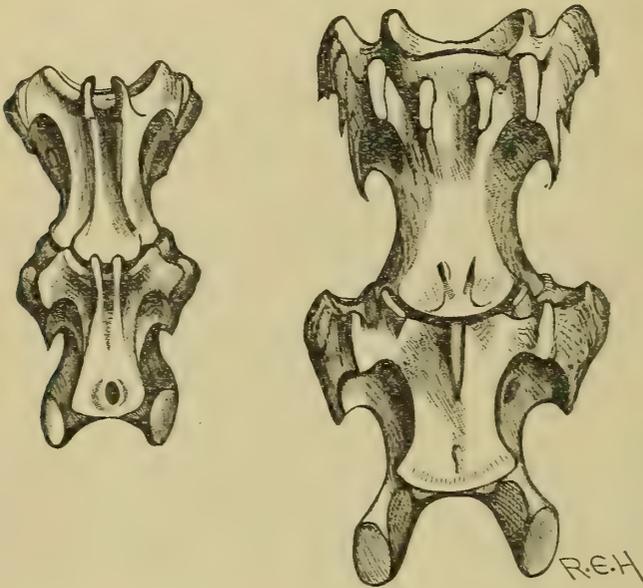
§ VERTEBRAL COLUMN.

Aramus has altogether 17 cervical vertebræ, thus disagreeing with at least many other Gruine birds, where 19 or 20 is the prevailing number; *Psophia*, however, and *Eupodotis* agree with *Aramus*. As the cervical vertebræ are apt to be variously reckoned by those who deal with the skeletons of birds, it may be as well to state that in the foregoing enumerations I have considered as "cervicals" all those vertebræ which lie in front of that which bears the first complete rib: while by complete rib, I understand one that articulates with the sternum. The atlas vertebra, as in *Grus*, is merely notched for the odontoid process of the axis. There is not a complete foramen.

On the cervical vertebræ the catapophyses, as is well known, are often, and indeed generally, of considerable use in distinguishing or uniting allied birds; they often vary very characteristically from family to family or it may be from genus to genus. In *Aramus* the arrangement of these ventral processes of the centra is as follows:—The catapophyses are first recognisable as quite independent on the 6th vertebra (counting in, of course, the atlas). From that vertebra as far as the 13th the catapophyses are clear and distinct and approach somewhat, being nearer to each other on the last three vertebræ of the series referred to; the approximation, however, is not clearly marked, and they are far indeed

from forming by their union a catapophysial canal, such as is to be found on the neck-vertebræ of many birds. It often happens that the vertebræ which immediately follow that which bears the last pair of catapophyses are furnished only with a single median hypapophysis, the transition being thus perfectly abrupt between the paired and unpaired ventral median process of the vertebral centra. Now, in *Aramus* there is a transition; for the fourteenth vertebra, although it has indeed but a single median hypapophysis, has that hypapophysis distinctly bifid at its free extremity, which

Fig. 1.



Neck-vertebræ of *Balearica* (right-hand figure) and *Aramus* (left-hand figure). Nat. size.

naturally suggests that it is the product of a fused pair of catapophyses. This process is not bifid upon the remaining hypapophyses of the cervical series. We may now compare the conditions which obtain in *Aramus* with those which prevail in other genera of the Gruidæ.

In *Grus carunculata*, which will serve as a type of the restricted genus *Grus*, the conditions are really practically identical. The only difference is associated with the larger number of the cervical vertebræ of this bird. In it the last vertebra which possesses paired catapophyses is the

14th instead of the 13th. Moreover, the bifid state of the otherwise unpaired hypapophysis of the succeeding vertebra—*i. e.*, the 15th of the entire series—is more marked than it is in *Aramus*; this is naturally still more suggestive of the origin of the unpaired hypapophysis from paired catapophyses than is the case of the 14th vertebra of *Aramus*.

In *Tetrapteryx* (or *Anthropoides*) *paradisea* there are exactly the same number of cervical vertebræ which possess catapophyses as in *Grus carunculata*, those of the 15th being quite as marked as are those of the 14th.

Balearica, in the points which are now being dealt with (fig. 1), does not show any special likeness to *Aramus*; it is indeed a step further on the Crane-side. In this bird there are in all, it will be remembered, 20 cervical vertebræ, instead of the 19 which characterize the more typical Cranes. As the cervical series is thus extended by one vertebra, it is natural to find that the arrangement of the catapophyses corresponds. In *Balearica* it is thus the 16th vertebra instead of the 15th which bears the last pair of catapophyses.

There is one remaining feature in the structure of these catapophyses which requires attention and furnishes useful comparisons. In *Balearica* the first pair of them is upon vertebra 6, as in the case of *Aramus*, already stated above. It will be seen, however, immediately, that these catapophyses are not certainly the equivalents of those which lie in *Aramus* upon the same vertebra. These processes in *Balearica* lie rather near to the middle ventral line of the centrum; they are placed behind a very deep ventral fossa which excavates the centrum of this vertebra just behind its surface for articulation with the preceding vertebra. This deep ventral fossa is not to be seen upon the next or upon any of the succeeding cervical vertebræ; there is no differentiation of the anterior from the posterior part of the centrum. In correspondence with, or at any rate associated with, this change in the form of the ventral surface of the centra the catapophyses move away from the position which they occupy on the sixth vertebra; they move forwards and come to have at the same time a more lateral position, or, to state the matter

more accurately, they appear to do so. For it seems quite possible that the first pair of median central outgrowths which have been spoken of above as "catapophyses" are not really the equivalents of the succeeding catapophyses. Although the two processes of the sixth vertebra enclose a gutter between themselves, yet their position is rather different from that occupied by the catapophyses upon subsequent segments. Moreover, the non-correspondence of the ventral paired processes of vertebra 6 in *Balearica* with the catapophyses lying upon the vertebræ which follow would seem to receive some support from a consideration of the nature and relations of processes upon corresponding vertebræ in *Tetrapteryx paradisea*; in the latter Crane, unquestionable catapophyses begin upon the sixth vertebra, but on the vertebra in front of this is a slightly bifid median spine lying behind the fossa already referred to. It might, of course, be suggested that this spine is the equivalent of the separate ventral processes of the sixth vertebra of *Balearica*. If we had only these two types to consider, the matter would be at least difficult to settle; but it seems to me that an examination of *Grus carunculata* solves the whole difficulty. In this Crane the first pair of catapophyses are upon the 5th vertebra; they are situated behind the fossa, but they are widely apart, so as to lie rather laterally as well as ventrally. These catapophyses belong to the category of the ventral processes which are not undoubted equivalents of those upon subsequent segments, but it will be observed that they approach them in the fact of their being more lateral in position.

Now, on the next vertebra, *i. e.* the sixth, there are lateral processes which no one could possibly refuse to regard as true catapophyses; and yet this vertebra has the median fossa of the one which precedes it. It is rather less obvious, but still it unmistakably exists. The difficulty therefore of homologizing these processes seems to be removed by an examination of the present species. It seems permissible then to look upon the catapophyses as "divided hypapophyses," which become more and more widely divaricated and finally

again fuse into a single median hypapophysis, rather than as detached processes from the sides of the ventral precentral fossa or parapophyses*. I may conclude this particular part of the subject by mentioning that *Aramus* agrees with the Cranes in having upon the fifth vertebra, behind the fossa already spoken of, a pair of low elevations which undoubtedly correspond to those of other Cranes, and are, in my opinion, the first pair of catapophyses. I shall not go into a comparison between *Aramus* and birds other than Cranes with regard to the matters that have just been treated of; I shall simply remark that in no bird which I have examined from this point of view are the likenesses to *Aramus* more considerable than are exhibited by the true Cranes. Indeed the similarity, as will have been apparent from the foregoing descriptions, almost, if not quite, amounts to identity.

Aramus has seven dorsal vertebræ, of which the last is fused with the sacral series, and is, as is shown in the accompanying figure (fig. 2, p. 42), covered by the ilia. The first, second, and third dorsals are also fused with each other; this fusion is complete, and there are no demarcations between the spinous processes of these vertebræ any more than there are between their centra: I could detect no traces of the sutures. At either end this series of three vertebræ is quite free from those adjacent. Other Cranes shew some differences from *Aramus* in the degree of the fusion of these vertebræ of the dorsal series.

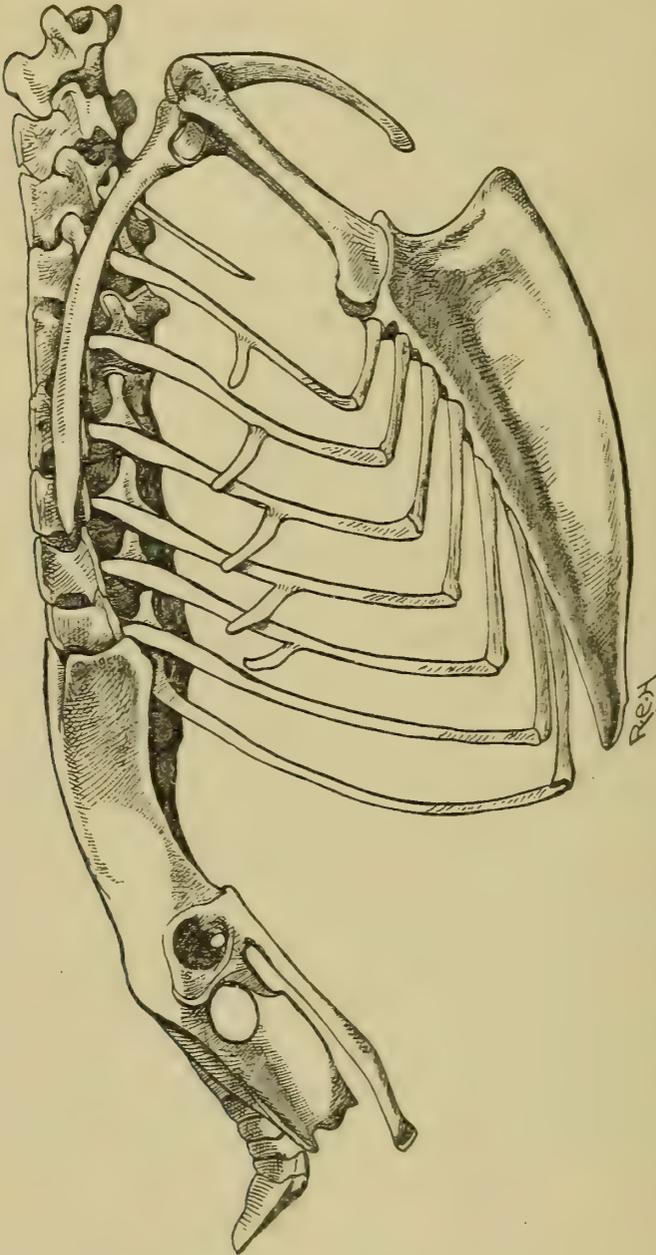
In *Grus carunculata* there is a ventral fusion which is not quite complete, and, moreover, only involves dorsal vertebræ 2 and 3. Dorsally, save for irregular splints of bone, which confer a practical rigidity upon this part of the vertebral column, the vertebræ in question are not fused with each other at all.

Grus australasiana exhibits a further advance upon *G. carunculata*. As in *Aramus*, there are three dorsal vertebræ which are fused together; but the fusion is undoubtedly partial, and they are only completely fused as

* In the Ostrich, for example (see Mivart, Trans. Zool. Soc. viii. p. 385), the catapophyses do appear to arise from the parapophyses.

regards their centra. The spinous processes are quite distinct and not fused at all; but this dorsal region of the vertebral column is doubtless as immobile as in *Aramus* by reason of

Fig. 2.

Thorax of *Aramus* ($\frac{3}{4}$ nat. size).

the fact that numerous spicules of bone lie across the junctions of the vertebræ, so that the arrangement is, so far, as in *G. carunculata*.

Tetrapteryx paradisea is characterized by a condition of

the three dorsal vertebræ which is precisely like that in the last-mentioned species: the vertebræ are united ventrally but not dorsally. In *Balearica* we again find an approximation towards the conditions observable in *Aramus*. Three dorsal vertebræ, which are, as in the other types, the first, second, and third of the series, are completely fused below; it is true that the fusion above is by no means so complete as in *Aramus*, but there are considerable bridges of bony matter uniting the spinous processes. The difference in these points between *Aramus* and *Balearica* is indeed not nearly so great as between either of these genera and *Grus* or *Tetrapteryx*. *Aramus* is only a short stage in front of *Balearica*; and both genera, it will be observed, must be regarded as comparatively specialized Cranes, since it cannot be doubted that the primitive arrangement is for the vertebræ to be separate and not fused at all. Such a point of resemblance, however, clearly need not be considered as one of affinity; no one can doubt that a more complete fusion between certain vertebræ is a specialization which might readily have been acquired several times independently.

With regard to this fusion between separate vertebræ of the dorsal series, I may observe that *Psophia* shews an advance upon *Aramus* and *Balearica*: in the former genus the fusion is so complete that even the intervertebral nerve-foramina are almost obliterated; those of *Aramus* are not nearly so much so.

There are some further minutiae of structure of the last cervical and the first dorsal vertebræ upon which it is requisite to insist, inasmuch as they offer points for discriminating *Aramus* from its allies among the Cranes.

In this genus the last two cervicals have, as has been stated, a single median hypapophysis. In addition to this process, which is strongly developed, there are two small lateral hypapophyses, one on either side of the median downgrowth; these two processes approach a little nearer to the ventral median line on the last than on the penultimate cervical vertebra. The first dorsal vertebra of *Aramus* is marked off from the cervicals by the fact that the two lateral processes cease to arise independently from the

centrum ; they ascend, as it were, the median single hypapophysis, which thus comes to possess a trifold structure. On the next dorsal vertebra the hypapophysis is no longer trifold, it is bifid. This change is due to the disappearance of the original median hypapophysis, which is replaced by the two lateral processes. The succeeding dorsals bear the merest traces of hypapophyses.

Now, in the genus *Grus* the conditions are a little different : in *Grus carunculata* the last four cervical vertebræ possess the two lateral hypapophyses, which, in successive vertebræ, gradually approach the median hypapophysis ; the latter, however, is so slightly developed that on the first dorsal vertebræ there are rather three hypapophyses than one strong trifold ventral process, such as we find in *Aramus*. On the vertebræ which follow, the processes in question are barely discernible ; they are indeed not recognisable at all after the second. It will be noted, however, that *Aramus* is essentially like the other Cranes in these points ; the arrangement in them is substantially that of *Aramus*, shewing indeed but the minutest differences of detail. Among other Cranes there is the same reduction in importance and size of the hypapophyses of the vertebræ in question ; *Aramus*, therefore, slightly exaggerates the Gruine characteristics, and so far it approaches two other anomalous Gruine genera, viz. *Rhinochetus* and *Psophia*.

The "sacral" region of the vertebral column is shorter in *Aramus* than in *Grus*, though only by one vertebra, so far as I can ascertain from a comparison of skeletons. The relations of the vertebræ of the pelvic region leave no possible doubt in the mind but that *Aramus* is most plainly a Crane in the strict and limited sense of the word, *i. e.* a member of the restricted family Gruidæ ; it differs precisely as do the Cranes from such outlying Gruine forms as *Psophia*, *Rhinochetus*, *Cariama*, and the Bustards. In *Aramus*, as in the Cranes, there are six vertebræ in front of the lateral acetabular fossæ*. Four or five vertebræ (I cannot make absolutely certain without injuring my skeleton of *Aramus*)

* I adopt this term from Mivart (Trans. Zool. Soc. x. p. 327).

occupy the region of these fossæ; behind the fossæ six (*Aramus*) or seven (*Grus*, *Balearica*) vertebræ are to be counted in front of the free caudals. Here is a minute point in which *Balearica* differs from *Aramus* and agrees with the more typical Cranes.

The caudal region of the vertebral column which follows the series of dorsals, lumbar, sacral, and caudals, which are sometimes termed "sacral," is slightly different in *Aramus* from the corresponding region in *Grus* and *Tetrapteryx*. In the two last-named genera there is an additional vertebra, which is, of course, present in *Aramus*, but is there fused with the "ploughshare" bone; *Aramus* has therefore only six apparent free caudals, whereas *Grus* and *Tetrapteryx* have seven. Between all the free caudals in *Aramus* there are well-developed intercentra; these are relatively large and single bonelets.

I have dealt at some length with the characters of the vertebral column, since, so far as I am aware, there has hitherto been no comparison of these bones together in the genera of Gruidæ with which I deal. It is clear that it is worth while to compare them, inasmuch as it should be evident that by these characters the essentially Gruine features of *Aramus* are made apparent, and at the same time certain differences sufficient to discriminate it from other Gruidæ become obvious.

§ RIBS.

As has been correctly stated by Prof. Fürbringer, in the tables of osteological characteristics of the different orders of birds which conclude his systematic summary of the group, there are six pairs of ribs in *Aramus* which reach, and articulate with, the sternum. In the skeleton studied by myself this is the case; but in addition a seventh pair actually reaches and touches the sternum, though not articulating with it. This seventh pair (see fig. 2, p. 42) is pressed close in between the rib in front and the sternum, but it is easy to be certain that there is no actual articulation. The sixth and seventh ribs, however, are in close adherence at the articulation of the former. This last rib

is naturally the one which is covered by the ilium at its origin. The first five of the complete ribs have uncinatè processes, of which the three in the middle are the longest. These uncinatè processes are so long that they overlap the rib behind. The rib-formula of *Aramus* will be therefore :

$$r + R + 6 + 1 \text{ (lumbar).}$$

This may be compared with the formulæ of some other Cranes :

$$\textit{Grus carunculata} : \quad r + R + 7 + 1 + r.$$

$$\textit{Tetrapteryx paradisea} : \quad r + R + 6 + 2.$$

$$\textit{Balearica chrysopelargus} : \quad R + 7 + 1 *.$$

I should explain that "r" signifies a small cervical rib not reaching the sternum, "R" a larger cervical rib still not reaching the sternum, the following figure (6 or 7 in the cases described) refers to the true dorsal ribs which articulate with the sternum, the next figure (1 in the case described) a dorsal rib which does not reach the sternum, and, finally, "r" a more rudimentary rib behind this ; both of the latter arise from vertebræ fused with the sacral series, and may therefore be termed lumbar ribs.

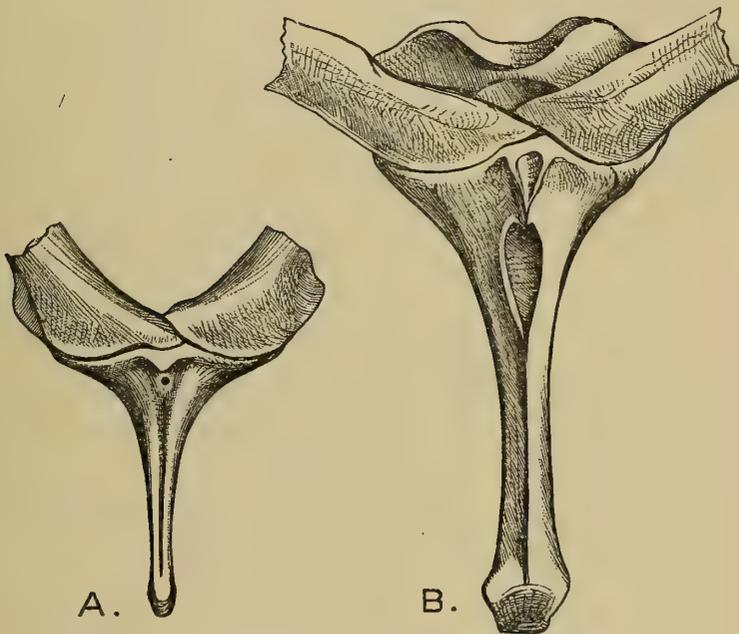
§ SHOULDER-GIRDLE AND STERNUM.

These parts of the skeleton have naturally been dealt with by Fürbringer, and therefore it will not be necessary for me to treat them with any elaboration. There is, however, one point of some little interest in the structure of the sternum with which I wish to deal : it is illustrated in the accompanying figure (fig. 3, p. 47), the two drawings in which represent the sternum of *Aramus* (A) and that of *Balearica* (B) viewed from the front, the keel being vertical in position. The spina externa of the sternum is asserted by Fürbringer, in his comparative tables of osteological characters on pp. 1582, 1583, of his 'Untersuchungen,' to be wanting in *Aramus*. I cannot altogether agree with him, though undoubtedly the process in question is so small as to be

* For formulæ of some other Crane-like birds see Beddard, P. Z. S. 1890, p. 439.

practically absent. In my specimen, as will be seen from the figure, there is a very small, but still very distinct, spina externa which lies in the proper position for such a process and may be compared with the admittedly present spina externa of the sternum of *Balearica*; these facts may be readily gathered from an inspection and comparison of the two figures submitted herewith (fig. 3, A & B). Now, in other Cranes this spina externa is large, but it bears a relation to the amount of complication shown in the windings

Fig. 3.

A. Front view of the keel of *Aramus*.B. " " *Balearica*.

of the trachea in those birds, where the tracheal loops may excavate the front end of the sternum; for example, the spina externa is very large in *Grus australasiana*, it is less in *G. carunculata*, and very small in *Balearica*, which, as a matter of fact, has not got a looped trachea. Associated with the looped trachea is the excavation of the front of the sternum, which is well known. Now it is highly interesting to note that in *Balearica*, as pointed out by Mr. Tegetmeier*, there is a small but deepish depression just below the small spina externa, which is most evidently a vestige, and that

* 'The Natural History of the Cranes' (London, 1881), p. 81.

not by any means minute, of this groove for the reception of a coiled trachea. I am disposed, therefore, to conclude that *Balearica* is derived from a Crane that had a coiled trachea and a corresponding deep excavation of the front end of the sternum. Now it is a point of some little importance, in estimating the systematic position of *Aramus*, to compare the conditions to be seen in this particular region of the bird with those observable in the Cranes. A glance at the figure already referred to (fig. 3, p. 47) will shew that in *Aramus* the front end of the sternum is excavated in the same way; but the excavation is much shallower, though even more extensive, than in *Balearica*. Furthermore, at the anterior end of the excavation, just below the rudimentary spina externa, is a deep hole (shown as a black circle in the figures) which has its precise counterpart in *Balearica*, though in the latter bird the hole in question is larger and deeper. It cannot, I think, be doubted that we have in this Crane-like bird a vestige of a former condition, in which the sternum was grooved and excavated in front for the reception of the tracheal coil. Here, again, I do not lay any special stress upon the likeness which *Aramus* bears in these peculiarities of structure to *Balearica*. It is readily credible that the tracheal coiling and the corresponding sternal excavation may have been independently lost a dozen times; but in any case both birds have progressed along similar lines.

Nor can I find any evidence that other Crane-like birds have recently lost their tracheal coils and are therefore to be looked upon so far as equally nearly allied forms of Gruine birds. In *Psophia*, *Cariama*, *Rhinocetus*, and *Houbara* the front end of the sternum—the region which is under discussion—is, it is true, flattened, but it is not in the least hollowed; and if it were to be suggested that flattening is simply a further, and not a large, exaggeration of the slight hollowing to be found in *Aramus*, it might be replied that in the birds mentioned the middle line of the region of the sternum, with which we are at present concerned, is traversed by a quite distinct ridge, which runs up to, and indeed up, the spina externa. All these facts combine, in my opinion,

to shew the justice of my comparisons of this part of the sternum in *Aramus* with that in the Cranes *sensu stricto*.

I may finally observe that the coracoids of *Aramus* overlap at their articulation, as they do in *Balearica*, but not in *Grus*.

§ PELVIS.

The pelvis of *Aramus* (fig. 2, p. 42) presents no marked divergences from that part of the skeleton in *Grus* and *Balearica*; nevertheless it can be readily distinguished by certain characteristics of its own. The chief difference in the pelvis of these various Gruine birds consists in the ratio of the pre-acetabular to the post-acetabular half of the ilium; this is shown very plainly in the following series of measurements:—

	mm.	mm.
<i>Aramus scolopaceus</i>	44	40
<i>Grus carunculata</i>	81	81
<i>Grus australasiana</i>	86	92
<i>Tetrapteryx paradisea</i>	75	82
<i>Balearica chrysopelargus</i>	75	79

The measurements were in every case made from the anterior end of the ilium to the anterior edge of the acetabular cavity, and again from the anterior edge of the acetabular cavity to the posterior end of the ilium. It is plain from them that *Aramus* has a relatively longer pre-acetabular region than has any other Crane. These measurements do not bring out any resemblance between *Aramus* and *Balearica*; on the contrary, *Balearica* is in the proportions of the two halves of the pelvis much more closely allied to *Tetrapteryx*. I may add that in these same proportions *Aramus* is less Crane-like than are *Psophia*, *Cariama*, and *Rhinochetus*; but it will be noted also that the true Cranes differ very considerably among themselves in the pre-acetabular and post-acetabular lengths. The breadth of the ilium of *Aramus* is greater in proportion to the length of the same than in any Crane of which I have made measurements, with the exception of *Balearica*. This will be

apparent from the following series of measurements, which are based upon taking the entire length of the ilium from its anterior extremity to the end of its attachment to the vertebral column behind at 100, the breadths being calculated as percentages. The measurements are :—

<i>Balearica chrysopelargus</i>	62·4
<i>Aramus scolopaceus</i>	61·3
<i>Grus australasiana</i>	56·5
<i>Grus carunculata</i>	54·3
<i>Tetrapteryx paradisea</i>	51·6

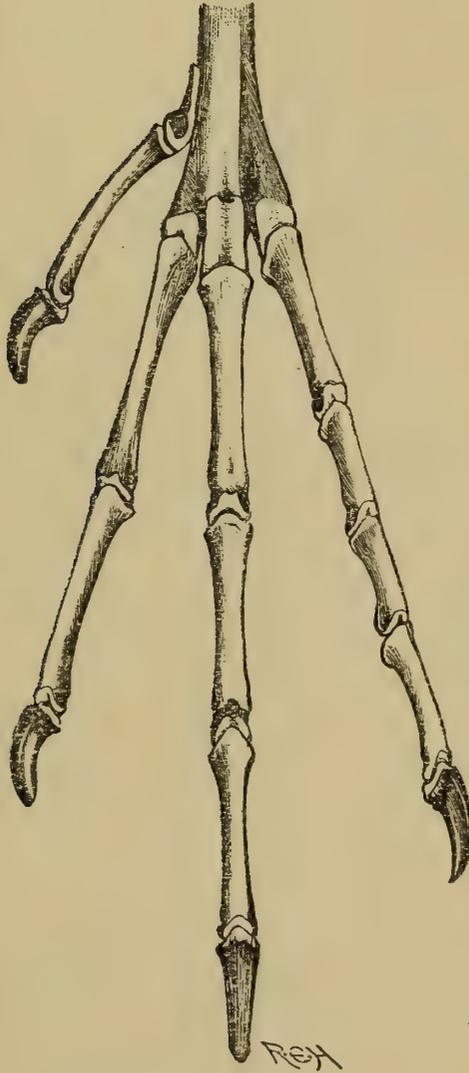
It is clear that the most marked break in this series, which is arranged in numerical sequence, is between *Balearica* and the rest of the true Cranes; furthermore that *Balearica* is very close to *Aramus* in these proportions. If the Cranes were to be classified by this character alone, *Aramus* and *Balearica* would be placed together and contrasted with the remaining genera.

§ THE HIND LIMB.

I do not find my measurements of the femur, tibio-tarsus, and tarso-metatarsus of *Aramus* quite in accord with those given by Fürbringer. He gives the respective lengths as 23, 39·5, and 37·5, the length of the entire limb being considered as 100. I find in my skeleton of *Aramus scolopaceus* that the actual lengths are—femur 3 inches, tibio-tarsus 6 inches, and tarso-metatarsus 4½ inches; or, to make use of the more accurate system of measurement in millimetres, femur 81 mm., tibio-tarsus 152 mm., and tarso-metatarsus 112 mm. These lengths give, when reduced to percentages of 100 for the whole limb, 23·5, 44, and 32·5. The differences in the measurements of Fürbringer and myself are not very great; but they are of importance to me as showing a closer resemblance to *Balearica* than would appear from the measurements of Fürbringer. The various segments of the hind limb of *Balearica* measure in millimetres 120, 263, and 230; reduced to parts of 100 these measurements become 19·6, 42·9, and 37·5 (not going beyond one place of decimals). This is clearly a series of measurements which

brings *Balearica* very close to *Aramus*; in *Grus carunculata* the tibio-tarsus and tarso-metatarsus are respectively $13\frac{1}{2}$ and 12 inches long, which gives quite different proportions. It has been pointed out that the great length of the toes in *Aramus* is a Rail-like character. They are undoubtedly

Fig. 4.

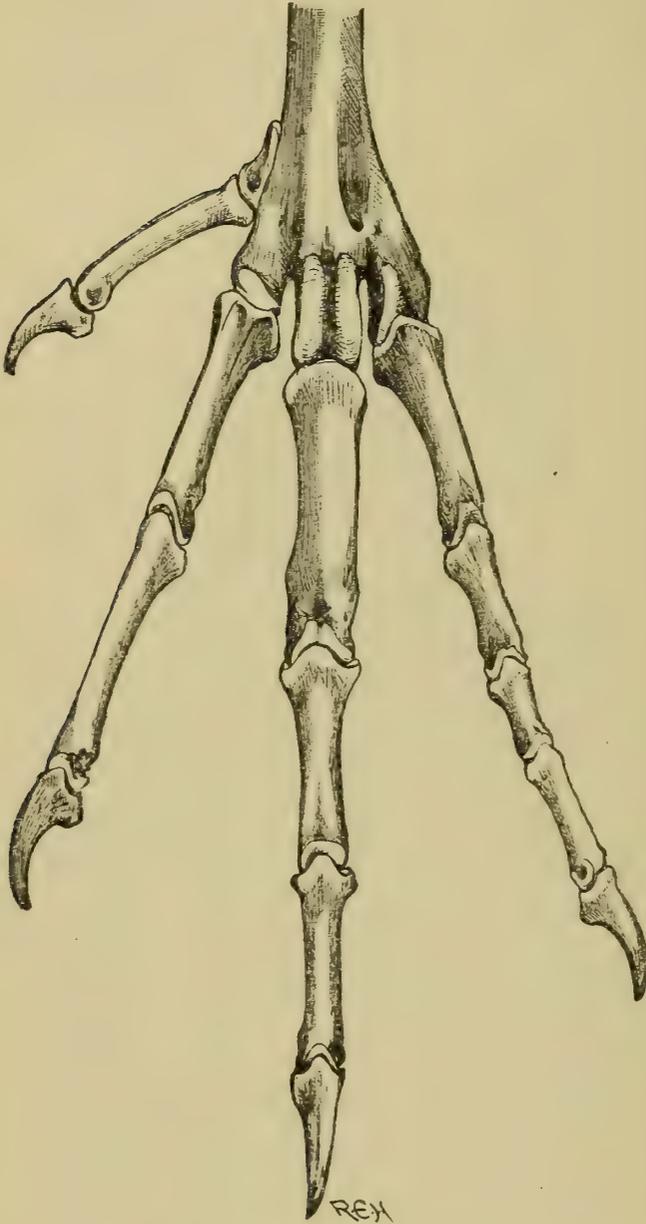
Foot of *Aramus* ($\frac{3}{4}$ nat. size).

longer than those of the Cranes, but they shew other differences which I desire to point out as a final contribution to the osteology of this bird.

The figures which accompany this description (figs. 4 & 5, pp. 51, 52) represent the feet of *Aramus* and of *Balearica*;

Balearica is here selected as representing the typical Cranes, for it shews no approximation to *Aramus* in the characters to which I am about to call attention. It will be observed

Fig. 5.

Foot of *Balearica* ($\frac{3}{4}$ nat. size).

that in *Aramus* the length of the phalanges of the several toes differs from that in *Balearica*: in the former genus the second digit has its first phalanx of equal breadth, or nearly so, to the corresponding phalanx of digit iii.; moreover,

the first phalanx of the second digit is distinctly longer than that of the third digit. In *Balearica* and *Grus*, on the other hand, the first phalanx of the third digit is distinctly the longest as well as the broadest.

In the foregoing pages I have added a few fresh details to our knowledge of *Aramus*, which shew how very closely related the genus is to the other Gruidæ, and which help to forbid its separation as the type of a family or subfamily distinct from them. The most important of these further likenesses between *Aramus* and *Grus*, &c., concern the vertebræ and the vestiges of an excavation upon the front edge of the sternum (see above, fig. 3, p. 47), which is to be compared to the deep furrow which in the genus *Grus* lodges the windings of the trachea ; on the contrary, some few of the fresh facts recorded in the present communication serve to distinguish *Aramus* from other Cranes. Of these differences a large proportion serve at the same time to cement more closely a special alliance between *Aramus* and the at least equally aberrant Crane *Balearica*. Such likenesses as are shown by the great breadth of the pelvis in the two genera, by the proportions of the segments of the hind limb, by the absence of the extension of the squamosal so as to conceal the quadrate, and the overlapping of the coracoids at their articulation with the sternum, seem to be so far genuine points of likeness which bear no obvious relation to adaptation to similar needs ; but they appear to be too few and of insufficient importance to afford a base for any claim to very near affinity between the two widely separated genera. There are, however, a number of other points of resemblance which are more striking : these are the loss of even the rudiments of the basipterygoid processes, the slightly grooved anterior edge of the sternum with its anterior foramen, and the more complete fusion of the first to the third dorsal vertebræ ; but these features of likeness between *Aramus* and *Balearica* might be interpreted as simply a parallel advance in each case from the structure of the more generalized Cranes of the genus *Grus*. Fürbringer considers that the genus *Aramus*,

on the whole, should be placed beneath the more typical Cranes, though it may shew points of specialization. Osteologically, it appears to me that *Aramus* is distinctly more specialized than its allies; in any case I am convinced that it is necessary to leave it as a genus of the family Gruidæ, and not to create for it a special family or subfamily. Its main claim to be considered as nearly related to *Balearica* appears to me to lie in the fact that both these genera have been specialized from the more typical Crane-structure along the same lines.

III.—*Further Information on two recently described Species of Passerine Birds.* By JOSEPH I. S. WHITAKER, F.Z.S., M.B.O.U.

(Plates II. & III.)

IN the 'Bulletin' of the British Ornithologists' Club for 1901 (vol. xi. p. 52) a new species of Long-tailed Titmouse from Sicily was described by me under the name of *Acredula sicula*, specimens of the bird having been exhibited at the meeting of that Club held on the 20th of March, 1901.

Having since obtained further information respecting this interesting addition to our European Ornis, and particularly as regards its distribution and breeding in Sicily, I think it worth while to publish the result of my investigations in 'The Ibis,' and at the same time to give a figure of the new bird.

As will be seen by Plate II., the Sicilian Titmouse greatly resembles *A. caucasica*, but, as mentioned in the 'Bulletin,' it differs from that species in its smaller size, and also, to a certain extent, in the colouring of its plumage.

The following are the respective measurements of the two species, as given in the 'Bulletin' of the B.O.C. :—

A. sicula ex Mus. J. I. S. Whitaker, Palermo :

♂ ad. Total length 5·0, wing 2·25, tail 2·9, tarsus 0·6.

♀ ad. „ „ 5·0, „ 2·20, „ 2·9, „ 0·6.

A. caucasica ex Owens College Mus., Manchester :

♂ ad. Total length 5·5, wing 2·45, tail 3·3, tarsus 0·7.

♀ ad. „ „ 5·5, „ 2·45, „ 3·2, „ 0·7.